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THESIS

THE FEASIBILITY OF WEB-ENABLED DIGITIZED VIDEO IN A LEARNING ENVIRONMENT

by

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September 2003

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13. ABSTRACT ***(maximum 200 words)***

Traditional methods of instruction limit a person's ability to gain required knowledge, yet many advanced technologies are not used. The potential is unlimited when digitally videotaping a course. Streamlining video over the Internet (wireless or hardwire), Digital Versatile Disc (DVD), Video Home System (VHS), and other modes of multi-media delivery, many of which are accomplished with little or no coordination, may be the wave of the future.

The technology and flexibility provided by digitizing a course may be extremely beneficial and cost effective. In addition, if educators use methods of network, customer relations, and knowledge management to implement and to maintain processes, operations tend to run smoothly from start to finish.

Essentially, digitally videotaping a course makes it possible to disseminate lessons to facilities by accessing the Internet, and providing that data to organizations with computer hardware and software, or simply store that data for future use. Adopting this method enables the product to be created efficiently and expeditiously. Whether at a university, a government installation, a civilian organization, or on a ship, by employing the hardware and software to show digitized video, educators can disseminate courses to enhance the learning process in a timely and fairly inexpensive manner.

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THE FEASIBILITY OF WEB-ENABLED DIGITIZED VIDEO IN A LEARNING ENVIRONMENT

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ABSTRACT

Traditional methods of instruction limit a person's ability to gain required knowledge, yet many advanced technologies are not used. The potential knowledge acquisition is improved when digitally videotaping a course. Streamlining video over the Internet (wireless or hardwire), Digital Versatile Disc (DVD), Video Home System (VHS), and other modes of multi-media delivery, many of which are accomplished with little or no coordination, improve knowledge delivery systems.

The technology and flexibility provided by digitizing a course may be extremely beneficial and cost effective. In addition, if educators use methods of network, customer relations, and knowledge management to implement and to maintain processes, operations tend to run smoothly from start to finish.

Essentially, digitally videotaping a course makes it possible to disseminate lessons to facilities by accessing the Internet, and providing that data to organizations with computer hardware and software, or simply store that data for future use. Adopting this method enables the product to be created efficiently and expeditiously. Whether at a university, a government installation, a civilian organization, or on a ship, by employing the hardware and software to show digitized video, educators can disseminate courses to enhance the learning process in a timely and fairly inexpensive manner.

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ACKNOWLEDGMENTS

> The Lord is my light and my salvation whom shall I fear? The Lord is the stronghold of my life of whom shall I be afraid? -Psalm 27:1

Through trials and tribulations the journey is complete; although lengthy, it was undoubtedly worth staying the course. The Lord our God is the first I must thank, because without his blessings nothing else is possible. My family and friends have endured much for the United States Navy, and me and for their selflessness, sacrifices, and love, I thank them from the bottom of my heart. I give unsurpassed thanks to my thesis advisor, Dr. Norman F. Schneidewind and my associate advisor, Professor Brian Steckler for their guidance, patience and never-ending assistance. Finally, I thank the NPS faculty for their flexibility and unyielding support from day one.

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EXECUTIVE SUMMARY

The objective of this thesis is to determine the feasibility of web-enabled digitized learning for virtually any facility. Determining the feasibility of web based digitized video in a learning environment will be done by digitally taping, editing, and forwarding a simplified prototype to the customer. At the conclusion of the research, digital taping, editing, and testing processes, it will be clear as to whether or not a course normally taught in a classroom environment can be streamlined and forwarded to any facility with access to the Internet. In addition, the reader will be given a variety of techniques for managing a web-enabled digitized video project within an organization and over the Internet.

The Internet has greatly improved the learning process through information speed and accessibility. Despite this, the need to learn has been a constant effort since the beginning of time, and to have current readiness, one must have and must maintain quality of work. In order to achieve quality work, knowledge and continuous learning is necessary. From early days to modern times, learning has always been needed for human survival, and the methods for learning have evolved into various techniques to achieve the desired outcome.

Compared to traditional learning, web-enabled digitized video is readily accessible, but once accessed, the quality and content of the output are major factors. For example, a professor can begin a lesson every day at three o'clock in the afternoon, have his lesson prepared in advance, and deliver it as planned. In contrast, unless the digitized video was copied onto a DVD, downloaded or created in a streaming format and reviewed in advance, there could be problems.

The world will continue to change, and through the advances of technology, it will also evolve. As stated in this thesis, training has continually undergone adaptations and is now using a variety of new technologies to achieve the goal of providing quality lessons to personnel. Organizations that use web-enabled digitized lessons to train their personnel will empower them to compete in the future.

For the purpose of this thesis, three experiments were conducted. The first was digitally taping a live classroom. The second was taping the class using VHS then converting it to digital form. The third was a combination of experiment one and traditional learning. With each experiment, the concept of simply creating a movie and playing it over the Internet remained in tact, but the concept began to fade quickly during the first experiment. It becomes obvious that when making the movie in a web-enabled digitized form to send over the Internet, the process is not as simple as "lights, camera, action".

Concerns involved creating the digitized video, as well as managing the project processes. An organization or a project for web-enable digitized learning should function as intended and should achieve its objectives. That means that it must operate correctly, and people must do what is necessary to ensure that the operation advances properly. To maintain operational order within this sort of project, the project manager for creating and disseminating a web-enabled digitized video must constantly be evaluating its output. The project manager cannot tell if the project is or is not running properly until the output from the digitized video has been analyzed. This process is one of continuous improvement, but there are many management tools, such as network, customer relations, and knowledge management, to help make the project run its course as smoothly as possible.

In conclusion, as indicated from the three experiments, web-enabled digitized video in a learning environment is feasible and extremely beneficial for the students as well as the professors. Through advanced technology and multimedia hardware and software, combined with traditional learning methodologies, the customer needs are undoubtedly met. The primary disadvantage of the entire process is that the creating, implementing, and maintaining a digitized video can be very time consuming and is not as simple as previously assumed.

I. INTRODUCTION

> Manpower is, and will remain, our Navy's biggest challenge. We are at war for people and we are fighting this war on three fronts — recruiting the right people, raising retention, and attacking attrition. To win, we need the involvement of every leader at every level, from admirals to third class petty officers and seamen — everyone who has Sailors working for them. All of you directly affect our success on this issue, through your own personal actions and through your chain of command.
>
> CNO - Manpower

The objective of this thesis is to determine the feasibility of conducting web-enabled digitized learning for virtually any facility. Determining the feasibility of web-based digitized video in a learning environment will be done by digitally taping, editing, and forwarding a simplified prototype to the customer. At the conclusion of the research, the digital taping, editing, and testing processes, it will be clear as to whether or not a course normally taught in a classroom environment can be streamlined and forwarded to any facility with access to the Internet. In addition, the reader will be given a variety of techniques for managing a web-enabled digitize video project within an organization and over the World Wide Web.

The objective of this thesis ties directly into the above quote on manpower. Training helps personnel become confident about their jobs and enables them to be happier and encourages them to remain in their organization. Conversely, personnel that are not very confident about their jobs often become frustrated and leave their organization.

A. THESIS STATEMENT

With respect to information technology and the feasibility of web-enabled digitized video in a learning environment, this thesis shows that these methodologies are routinely being done today. In addition, three experiments were conducted to determine the best method to digitize video and forward it via the web.

This thesis determined the feasibility of web-enabled digitized video and describes three methodologies for creating the digitized video. Then it shows how once the video is digitized, it can be forwarded virtually to any facility, whether ashore or afloat, to enhance the learning environment.

The three methods used to digitize and to forward video were 1) Live digitized recording - recording of a live audience with a digital camera, 2) VHS to digital conversion - a video teleconferencing tool used to capture video and to convert it to digital, and 3) A combination method 1 and traditional learning methods. The description of each will enable the reader to determine which of the three was deemed the best method.

B. MOTIVATION

Apart from the three methodologies used to digitize the video and the actual means of editing and forwarding the finished product, the following will also be briefly discussed:

- The importance of knowledge management and how knowledge adds value to the process.
- The importance of Customer Relations and how it influences the final digitize video output.
- How database management and web-enabled technologies can help ease the process in the future.
- Why having a basic understanding of the equipment, software, and networks involved in the process is significant.

Specifically, the motivation behind this research was based on two facts. The first is that many personnel do not have the opportunity to sit in a classroom and obtain specific knowledge. Although having a live instructor readily available is invaluable, the ability to receive the lessons, whether an instructor is in the same building or on the other side of the world, is priceless.

The second fact is that web-enabled digitized video in a learning environment allows students to learn at their own pace. In the traditional classroom if a student is not able to grasp the material as quickly as the other classmates, either that student or the entire class could suffer. But with digitized video, a lesson can easily be learned at a fast or slow pace without interfering with the progress of others.

In addition, web-enabled digitized learning takes advantage of combined media components. Through advanced technology students can learn concepts easier, making the learning process a more pleasant experience for both the student and the educator. Teachers become more creative as they impart concepts in a more interactive way, as opposed to only producing presentation slides or using plain text from a book. For example, when military personnel have the opportunity to use web-enabled digitized video, their chances of obtaining and retaining job-specific knowledge is greater. Since these personnel can be on ship, land, or in the air at any given time, through Internet access and digitized video lessons, they can obtain the lesson, study it, store it, and repeat the process at their convenience.

C. RESEARCH QUESTIONS

Throughout this thesis, the five questions below will be answered in detail:

- What impact would a digitized web-enabled course have on the training of personnel?
- Is digitized video a good vehicle to provide the course information to personnel?
- What are the most current methods of capturing the information in the course and disseminating it to numerous learning environments?
- What is the most economical method for capturing and disseminating the course or sections of it?
- How else can a digitized course be used?

D. MAIN GOAL

The number one goal of this thesis is simply to make educators aware of a viable tool to assist them in providing quality lessons to personnel near or far.

E. THESIS ORGANIZATION

The organization of the chapters in this thesis is as follows.

Chapter I: Introduction. This chapter contains the thesis statement, an overview of the paper and results, the motivation, the research questions, and the main goal of the thesis.

Chapter II: Background. This chapter presents a review of prior and current work in the area of web-enable digitized video. Traditional learning and teaching methods are compared to digitized video.

Chapter III: Capture, Design, and Format for Digitizing Video. This chapter discusses the approach this thesis takes in determining the feasibility of digitized video in a learning environment. In addition, it provides details on experiments one, two, and three, summarizes the finding of each, comments on the major hurdles, and suggests which method is best to use.

Chapter IV: Plan, Organize, and Implement: Processes for Disseminating Video. This chapter introduces various techniques that could assist in managing a web-enabled digitized video project. It also briefly explains the benefits each management technique can provide.

Chapter V: Conclusions and Recommendations. This chapter summarizes the strengths, weaknesses, and a result of each experiment and provides various techniques for managing a web-enabled digitized video project. It also recommends possible future work on the subject.

II. BACKGROUND

> The best quality of work that I know of is when you're on the other side of the world taking on the enemy; you know you're going to come home victorious. That's why current readiness is where it is.
>
> CNO – Current Readiness

A. TRADITIONAL LEARNING

The need to learn has been a constant effort since the beginning of time, and in order to have current readiness, one must have and maintain quality of work. In order to have quality of work, knowledge and continuous learning is necessary. Throughout history, learning has always been essential for people to survive; yet the methods for learning have always evolved to elevate the process and results of education. The scientific investigation of the learning process was begun at the end of the 1880s, through the work of Ivan Pavlov in Russia and Edward Thorndike (Thorndike, Wikipedia) in the United States. Three models are still widely used to explain changes in learned behavior, to emphasize the establishment of relations between stimuli and responses, and the third emphasize the establishment of cognitive structures. Albert Bandura (1977) maintained that learning occurs through observation of others, or models. Learning through mimic or influence is revealed when children imitate their parents' behavior. Moreover, today it has been suggested with strong evidence that such learning occurs when children are exposed to violence in the media. Therefore, one could deduce that learning via web-enabled digitized video enhances the student's ability to grasp the concepts.

Pavlov initially identified the first model, classical conditioning, in the salivation reflex of dogs. Salivation is an innate reflex, or unconditioned response, to the presentation of food, an unconditioned stimulus. Pavlov showed that dogs could be conditioned to salivate merely to the sound of a buzzer (a conditioned stimulus) after it was sounded a number of times in conjunction with the presentation of food. Learning is said to occur because salivation has been conditioned to a new stimulus that did not elicit it initially. The pairing of food with the buzzer reinforces the buzzer as the prominent stimulus.

A second type of learning, known as “operant conditioning”, was developed by Thorndike around the same time as Pavlov's theory and was later expanded upon by B. F. Skinner (Skinner, p. 52, 1968). In operant conditioning learning takes place as the individual acts upon the environment. Whereas classical conditioning involves innate reflexes, operant conditioning requires voluntary behavior. Thorndike showed that an intermittent reward is essential to reinforce learning while discontinuing the use of reinforcement tends to extinguish the learned behavior. The famous “Skinner Box” demonstrated operant conditioning by placing a rat in a box in which the pressing of a small bar produces food. Skinner showed that the rat eventually learns to press the bar regularly to obtain food. Besides reinforcement, punishment produces avoidance behavior, which appears to weaken learning but not curtail it. In both types of conditioning, stimulus generalization occurs; i.e., the conditioned response may be elicited by stimuli similar to the original conditioned stimulus but not used in the original training. Stimulus generalization has enormous practical importance because it allows for the application of learned behaviors across different contexts. Behavior modification is a type of treatment resulting from these stimulus and response models of learning. It operates under the assumption that if behavior can be learned, it can also be unlearned.

A third approach to learning is known as cognitive learning. Web-enabled digitized video in a learning environment allows the student to repeatedly view the video as often as it takes to understand the lesson. Wolfgang Kohler (Kohler, 1997) showed that a protracted process of trial-and-error might be replaced by a sudden understanding that grasps the interrelationships of a problem. This process, called insight, is more akin to piecing together a puzzle than responding to a stimulus. Edward Tolman (1958) found that unrewarded rats learned the layout of a maze, yet this was not apparent until they were later rewarded with food. Tolman called this latent learning, and it has been suggested that the rats developed cognitive maps of the maze that they were able to apply immediately when a reward was offered.

Although learning through a computer-base digitized video incorporates types one, two and three, its style identifies most with the third approach, cognitive learning. In an organization such as the US Navy, learning takes place in systems of interrelated roles both formal and informal. Training in a specific subject could be needed during

peacetime or wartime operations, weather at sea, on land or in the air. This is a main reason that virtually any facility with specific learning needs can benefit from web-enabled digitized video in a learning environment.

B. DIGITIZED VIDEO

Compared to traditional learning, concerns with web-enabled digitized video are mainly accessibility; but once accessed, the quality and content of output are also major factors. For example, a professor can begin a lesson every day at three o'clock in the afternoon, have his lesson prepared in advance, and deliver it as planned. In contrast, unless the digitized video was dropped to a DVD, downloaded or created in a streaming format and reviewed in advance, problems could ensue.

The process of creating a digitized video is not so simple as running the video into the computer and looking at the resultant file, as will be noted in the experiments to follow, if done incorrectly, the results can range from very dark and degraded digitization to a clear picture with bad sound to a quality product with clear video and sound. Issues, such as tuning picture and audio quality, which video producers take for granted, can develop. In such cases, the producer can make corrections such as image brightness and sound as part of the overall process, but for the novice, these adjustments can be very challenging.

Video can be digitized into multiple digital formats, such as QuickTime and audiovisual interface (AVI) for (PCs) and (MACs). These formats require that they be downloaded from the web prior to viewing. Casual viewers are usually willing to wait 30 seconds in length to download, but their patience drops off sharply as the video download time increases. An alternate means to downloading digitized video is to provide streaming video to the viewer.

Two types of streaming video are currently available, which do not require the viewer to wait for downloading: VDOLive and Xing. Reviews of these formats, such as "Web-Enabled Video", of PC Magazine, March 26, 1996, consider them highly promising but not quite ready for commercial use. In order to move the vast amount of information in video across the viewer's connection, making some compromises in the quality of the video image or in the smoothness of the motion is necessary.

VDOLive has chosen to compromise on the quality of the video image and to maintain the smoothness of the video motion. This means that the fastest lines have the clearest image and the slowest lines, such as 14.4 KB modems, lack clarity. Therefore, through professional video manufactures, VDOLive videos can be created for the viewer, but the viewer must have a VDOLive server in order to play the video. The tradeoff that Xing has chosen is to reduce the smoothness of the video motion and maintain the image quality. This can mean that the normal 30 video frames per second can be reduced to as few as one or two. In the future these numbers will increase, but with the current technology, this is the best available.

One of the many advantages to digitized video is that it has a variety of options that were not available through traditional learning, options such as DVD's, digital download, and streaming video; but despite such options, there are other tradeoffs. Each digitized video creator and viewer will have different disadvantages, such as a mediocre picture but excellent sound or lengthy download but very good picture quality. Once the tradeoffs are determined, the digitized video can be disseminated through either the web or a removable medium. No matter how digitized video is disseminated, as long as it meets the creator and viewers' definition of acceptable standards, the lessons can be viewed day or night at the convenience of the viewer.

C. PRIOR WORK WITH WEB-ENABLED DIGITIZED VIDEO

Web-enabled digitized leaning is a fairly new form of education. This form of education can be divided into three phases. Education often adopts innovative technologies and these three phases are closely related with the growth of information distribution through the last two centuries.

During the 19th century and the early part of the 20th century, mail services were the main method of communication and information distribution. Printing materials and books were delivered by mail services, as correspondence courses were the main tool of distance education. Correspondence educators monitored the learners by responding to mailed-in assignments. That was the correspondence phase of web-enabled education.

After analog signals were used in the beginning and middle of the 20th century, the barrier of physical distance was greatly reduced. New technologies, like the

telephone, the radio, the television and broadcasting, were widely used to provide distance education. This strategy gained more advocates in education. In the 1960's and 70's saw the inception of the analog signal phase for education. Some methods of that phase are still used today.

With the advent of the information age, technology innovations have provided fundamental mechanisms for web-enabled digitized learning. The wide spread of computers, multimedia, fast communications, and computer networks have driven the development of web-enabled digitized video to the learning forefront. Society is now traveling through a phase of education based upon the information age. Through the progress of technology, web-enabled digitized learning has flourished over the last few decades, becoming essential to modern education. Today the number of people studying through web-enabled digitized lessons is between 20 and 30 million, and the majority of the students are adults.

The following table summarizes several important features of the two educational approaches:

Traditional Classroom Versus Web-Enabled Digitized Learning		
	Traditional Classroom	**Web-Enabled Digitized Learning**
Source of Information	Teacher/textbooks	Resources on Internet
Information Format	Text	Multimedia
Presentation Format	Linear	Hypermedia
Type of Interaction	Synchronous	Synchronous/Asynchronous
Interaction Space	Classroom	Networked world
Instructional Emphasis	Acquiring knowledge	Building knowledge
Objectives	Specific, pre-defined	General, negotiable

Table 1. Summary of Features of the Two Educational Approaches (From: Traditional Classroom Course - Web-Enabled Course).

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III. CAPTURE AND DESIGN/FORMAT FOR DIGITIZED VIDEO

> The power to compete in the future has everything to do with being credible today. The world is dangerous and unpredictable. Our Navy routinely operates in tough places, and that's as it should be. We work and operate in an atmosphere of risk, and we should not shy away from it. We should be credible and we should be ready. We must constantly challenge the assumptions that we face on a daily basis and adapt to an ever-changing world.
>
> CNO – Future Readiness

A. INTRODUCTION

As stated in the previous chapter, training methods have adopted and are now using a variety of new technologies to provide quality lessons to personnel. Organizations that use web-enabled digitized lessons to train their personnel will help them become ready and give them the power to compete in the future.

For the purpose of this thesis, three experiments were conducted. The first was digitally taping a live classroom. The second was taping the class using VHS and then converting it to digital form. The third was a combination of experiment one and traditional learning methodologies. With each experiment, the concept of simply creating a movie and playing it over the Internet remained in tact, but the concept evolved quickly during experiment number one as it became clear that a web-enabled digitization format was far more challenging than a tradition approach.

Creating a movie as an experiment seemed very logical. People use movies to visualize ideas that are difficult or impossible to present using other forms of media. Video is always a pleasant way for students to receive information. Nearly everyone has an experience when the teacher introduced a movie in the classroom to make a lesson more understandable. Movies represent a great challenge for computer systems since the necessary network capacity is quite large. As the bandwidth of the Internet grows, video on the web becomes more common. The quality of the movies produced for the web continues to grow as a result of improved hardware and software. Of course, video must be compressed in order to work on the Internet. Uncompressed video takes so much bandwidth that accessibility would be restricted. Several video compression standards

are commonly in use, including MJPEG, MPEG and MPEG-2. All these standards compress video files with a cost of lost data. When these losses are large, the quality of the movie suffers. There are two ways of providing video in a computer system. The first way is to download a movie file from the server. This approach may take a large amount of time depending on the file size, the network traffic, and the user's connection to the network. Movie files are used when the instructor uses the video as a supplement to the course content. The second way to download a movie is by using streaming video. The movie file is sent from a server and captured in a buffer but not stored permanently by the client's (the student) computer. As soon as enough information has been received, the movie starts playing. Again, the network traffic and the user's connection to the network play an important role for the reliable video transfer. The instructor uses streaming video to deliver live lectures. Also, discussion forums and other interaction sessions may be established among course participants using this kind of technology. Of course, one must be sure that the student's browser applications are equipped with the proper plug-in programs that may play the compressed movies.

The sound within a compressed movie is recognized as one of the emotionally most compelling media. It is also the core means of human communication. [Ref. 14:p. 148] There are different ways in which sound can be used in web-enabled courses. One way is "earcons", sounds that indicate a particular operation. Computers play sounds to indicate an event or an action, for example when a process is completed or e-mail arrives. These kinds of sounds are very useful when students interact with an educational action, giving them feedback when they are doing well or not.

A second way is informational sound that is used in web-enabled courses that indicates some special meaning about the data. The instructor may use this kind of sound to provide information about an image or an animation used in the course or to provide a summary of the topic analyzed in the web lecture. Another way to use sound is streaming audio, providing the same functionality as streaming video. It may be used, as streaming video, for live lectures or live communication among the course's participants. Also the instructor may record a lecture and provide the audio file to his students as a course supplement. It is important to know that sound files can take nearly as long to be

downloaded as movie files. Also proper plug-in programs are also needed by the student's web browser applications to play sounds; therefore, the hardware is also a major consideration, as it is with graphics.

Three-dimensional graphics are appearing on many web sites. These graphics are used to represent an object in such a way that the viewer can choose the perspective from which to view the object. They are also used to support the creation of virtual reality worlds. The instructor can use this to animate a concept. Also, most of the simulation programs use virtual reality environments. A special language, called Virtual Reality Modeling Language (VRML), is used to create web pages with this capability. Of course, a VRML plug- in program must support the student's browser in order to be able to see the virtual reality environment.

B. EXPERIMENT ONE: DIGITALLY TAPING LIVE CLASS ROOM

The goal of this experiment was to film the class as it was taught, and to simply play it back over the Internet. The viewing of a movie is easy, and to the viewer the creation of a film does not seem that difficult, considering all the technology that exits today, but as shown, the process can be very time consuming and complex.

To conduct this experiment, an instructor, 25 students, two camcorders, and 40 mini-digital cassette tapes were used to capture all 40 hours of the course. Camera one was placed toward the back of the room in the far left corner and camera two was placed at the front of the room, also in the left corner. The positioning of camera one enabled the instructor and part of the class to be filmed. The position of camera two enabled the entire classroom to be filmed. Although a direct current (DC) cord was used, a back up battery was necessary in case the distance the camera had to be moved exceeded the length of the cord.

For this method of video capture, the video and audio recordings can either be done simultaneously or separately. Each method has advantages and disadvantages. For example, if both sound and video are done together, there is no need to add them later, which is one less step in the editing process. On the contrary, if they are completed

separately, then the sound must be overlaid onto the video, which can be very time consuming. For the purpose of this experiment, the video and audio were captured simultaneously.

Prior to recording the subject, the lighting, the camcorder settings, and environment had to be considered. If the lighting is bad, it may be difficult to see the recorded video. If the settings on the camcorder are not correctly adjusted for the environment, the recorded video may look too bright, too dark, or the digitization may appear distorted. In addition, the environment itself must be considered. The word "environment" refers to every detail that may affect the recording, such as the location, color scheme or background noise.

The presence of background or outside noise is undesired and can be avoided by carefully arranging the audio equipment to fit the recording situation. As with video, sound is very important. In particular, the clarity of the subject, the volume, and the pitch, or the lack of volume in surrounding sounds, can misrepresent the recorded video subject point.

After each recording session, the digital tapes were loaded onto a laptop computer, and labeled according to the recorded lesson. After all 40 sessions were completed, the editing process began. The process of editing took days, not hours. A continuous effort was made to correct problems in sound and picture quality, as well as in the enormous bandwidth used, even after the video compression. For testing purposes, a small segment of the first class was used as a pilot for the remainder of the experiment, which consisted of disseminating the product to a unit afloat over the Internet.

In order to forward the product, a contract was created between a sponsor and the project manager. The following is a description of the events as they unfolded.

1. Customer, Requirements and Contract

The following details the communications between the sponsor and the project manager:

Four phone calls were made to the sponsor (CO of USS Carr), and throughout the conversations, the requirements were established. Since the USS Carr had just come off deployment, the CO wanted to give the members of his wardroom a reward that was

educational. He requested that the learning video be real world, non-technical, short, entertaining, yet apart from normal training. Therefore, the lesson that had been created was not what the customer wanted, so another lesson had to be created from scratch. Knowing the customers and their needs prior to creating the product would have avoided this unnecessary backward step. Customer Relationship Management will be briefly discussed in Chapter IV.

The CO requested that the matter be given some thought then to contact him as soon as possible. After brainstorming and communicating with the customer, it was agreed that a five-minute video lesson on Self-Defense would be created.

After deciding on the web-enable digitized lesson, other communications between the CO and the project manager focused on networks, bandwidth (BW) requirement, funding, and the future return on the investment (ROI). Bandwidth is always a concern and was disregarded for the purpose of the experiment (why?); this is because bandwidth problems will likely be resolved in the future. Concerning funding and ROI, the CO was informed that the USS CARR would incur no cost and the ROI would be huge if the experiment was successful. If successful, the pilot could become standard practice and could be expanded into other training areas needed by the ship. Therefore, instead of sending personnel on necessary and costly Temporary Assigned Duty (TAD), training could take place during slow operations on and off deployments. The ship would be able to reduce lost man-hours and would not have to pay for costly TAD.

The final communication prior to forwarding the digitized video was the establishment of a contract. The sponsor and project manager agreed to the contract terms in Appendix A.

2. Digitizing/Editing the Video

Again, the process of digitizing and editing the video was necessary. Since the process had been done before, the creator better understood how to manipulate the networks and software. Network and software management will be briefly discussed in Chapter IV. The process of digitizing and editing the video was done in three steps. First, the video was captured with the digital camcorder. Second, the editing process began. *Microsoft Producer* was used for this project. It was important to edit the video

in order to cut out dead time, which would unnecessarily lengthen the video and consume important bandwidth. Third, the video was compressed and converted for the purpose of streamlining.

In order to deliver digitized video effectively over the Internet, compressing the video was important. Compression allows the video to pass through low bandwidths easier and to be played on slower computers. Streamlining video does require a certain level of software manipulation skills, but after a short learning period, it is easier to complete. The video was initially stored as an AVI file, which is good for larger files, but the digital quality was very poor. The other method of storing the video prior to forwarding it was MPEG, since MPEG is good for small files and has high quality. However, for this particular situation with the USS CARR, streamlining by email was the fastest way to send the product to the customer.

3. Alternative Methods of Forwarding

Although steaming was the method of choice to provide the digitized video to the USS CARR, various methods to forward the video to the customer exist. However, some methods will be better and faster than others when the ship is deployed at sea. Additionally, cost and the availability of bandwidth are factors that must be considered.

The video could be recorded and copied to a CD-ROM or a VHS tape could be sent to the USS CARR by regular mail. This method would take much more time and would depend on how frequently mail was delivered to the ship. This is obviously not the preferred manner; the best way to get the video to the customer for reliability and speed at the lowest cost is the streamlining method.

4. Packet Switching

Packet switching is a main step in making this process work from consultant to customer. There is no need for a circuit to be established all the way from the source to the USS CARR by using this method. Consider a connection between the users A (NPS) and D (USS CARR), with B and C (relay stations) in Figure 1 below. There are a series of links (AB, BC, and CD), which the video must pass through in order to reach its final destination.

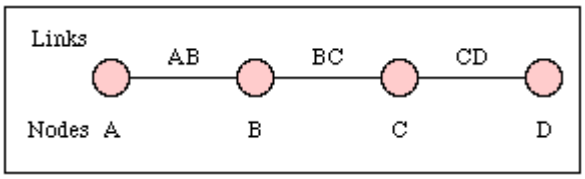

Figure 1. Links/Node.

For instance, when compressed video is sent from A to D, it first passes over a local connection (AB). It is then passed at some later time to C (via link BC) and from there to the destination (via link CD). At each message switch, the received message is stored, and a connection is subsequently made to deliver the message to the neighboring packet switch. Packet switching is also known as "store-and-forward switching" since the messages are stored at intermediate nodes to their destinations.

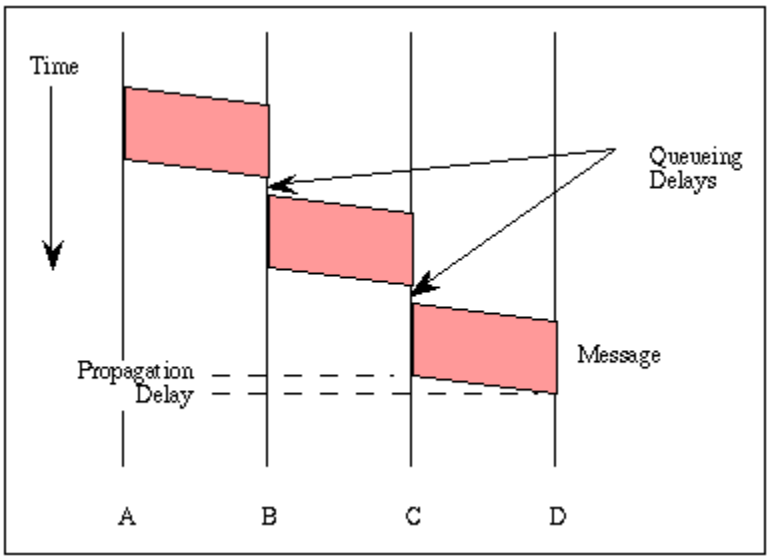

Figure 2. Compressed Video.

Figure 2 above illustrates packet switching; for simplicity, the transmission of only one message is illustrated. As the figure indicates, a complete message is sent from node A to node B when the link interconnecting them becomes available. Since the message may be competing with other messages for access to facilities, a queuing delay may be incurred while waiting for the link to become available. The message is stored at B until the next link becomes available, with another queuing delay, before it can be forwarded. It repeats this process until it reaches the USS CARR.

Circuit setup delays are replaced by queuing delays. Considerable extra delay may result from storage at individual nodes. A delay for putting the message on the communications link (message length in bits divided by link speed in bps) is also incurred at each node en route. Message lengths are slightly longer than they are in circuit switching, after establishing the circuit, since header information must be included with each message; the header includes information identifying the destination as well as other types of information.

Figure 3 below illustrates the use of a packet switching network.

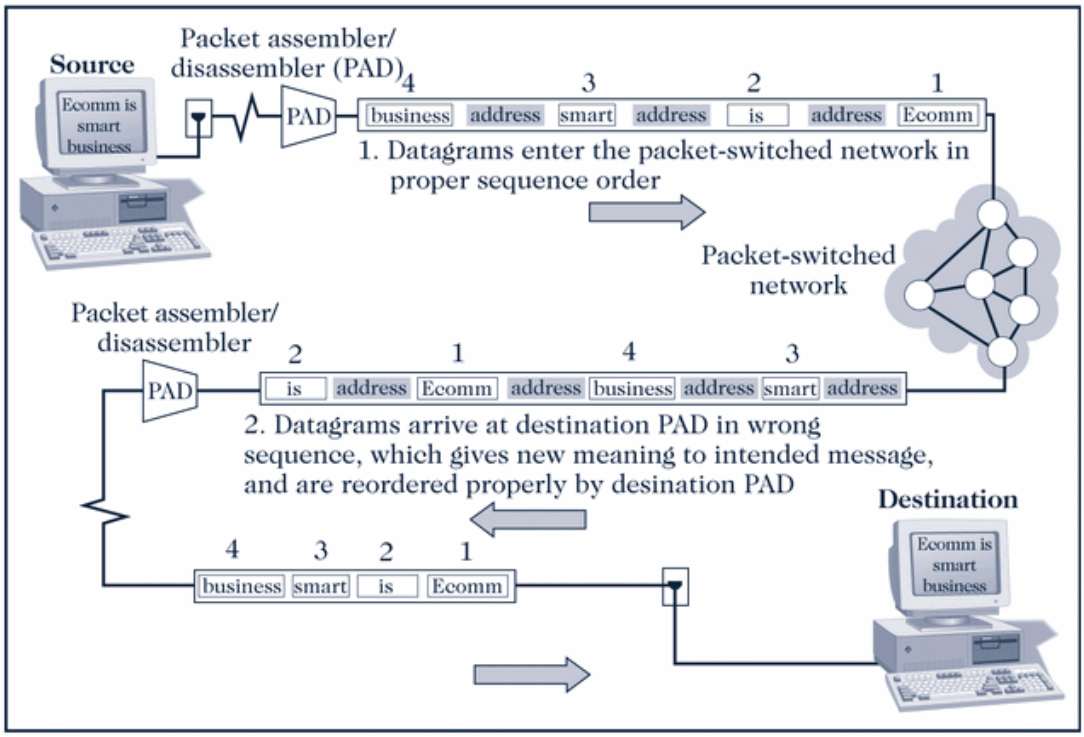

Figure 2-1 *Packet-switched network and message packets*

Figure 3. Packet Switching. (From: Network Management Brief, NPS IS Capstone Course).

5. Bandwidth

Bandwidth is the most challenging element of the process. The larger the file, the more bandwidth is needed to streamline the video. It is important to keep the video to less than 20-minute segments in order to minimize the bandwidth use. In addition, this will help maintain customer attention.

Today, all sailors aboard the USS CARR have Internet and e-mail access at sea. In the past, only high-ranking sailors could send e-mail and have access to the Internet while afloat and during deployment. Extending Internet access to the entire unit enables any sailors to download the learning video as long as the bandwidth permits.

Most sailors on the USS CARR are limited to 20 minutes a day on the Internet, and can reach only news, military, and financial sites. However, for training purposes, the time frame is increased significantly, and bandwidth is not wasted at sea.

The USS CARR is sensible in its bandwidth usage to ensure that personal traffic, such as online banking and downloading large files, does not interfere with military operations and training on the Internet. On a good day, a sailor on board receives about 256 Kbps of bandwidth to the Internet from the satellite link provided by the Navy, which also runs its own separate LAN on the ship. This monitoring is necessary, particularly in the evenings because when about 150 users are online simultaneously, it can slow the flow of data considerably, thus making it difficult for web-enable digitized learning to take place.

The following is a pictorial description of bandwidth.

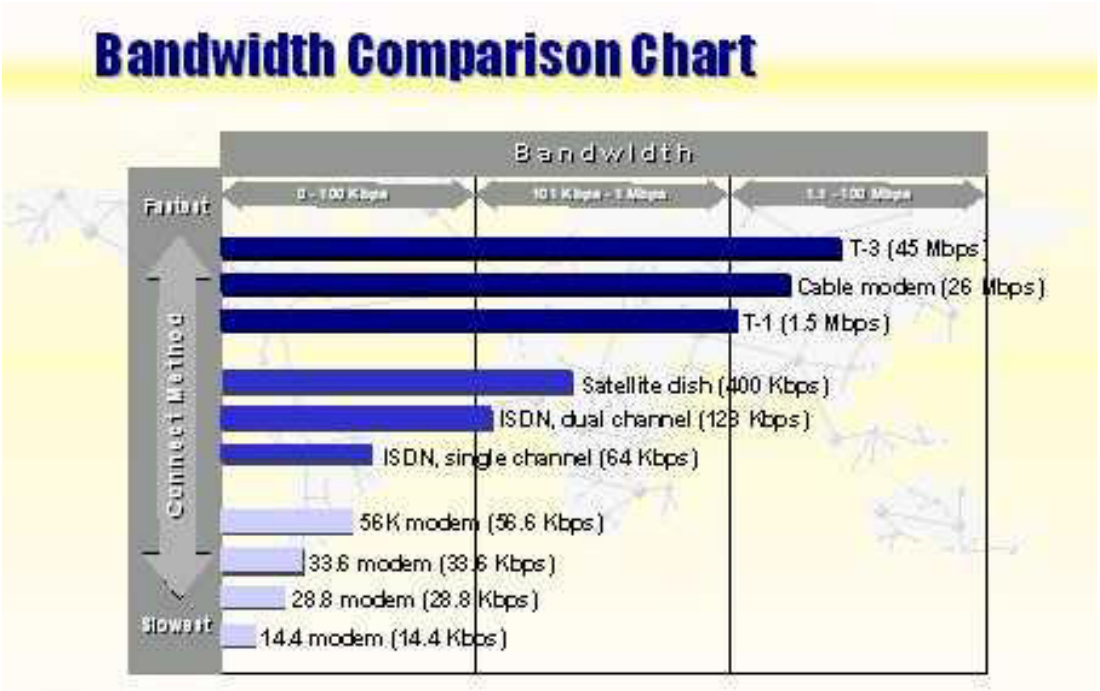

Figure 4. Bandwidth Chart. (From: www.air-internet.com/bandwidth)

6. Cost

a. Prototype Anticipated Funding Requirements

Anticipated l Funding Requirements		
Travel		**0.00**
Hardware & Peripherals:	Laptop Computers (x 1)	**$2,500.00**
	Portable Digital Video Camera (x2) (SONY) to include microphone and power cord.	$1,200.00 (each) **$2,400.00**
	Video Camera Tripod (x2)	$50.00 (each) **$100.00**
	Satellite Based Internet Access	**$0.00**
	Misc. (i.e. Zip ties, wire bundling accessories, etc)	**$500.00**
Software Applications:	Video editing Software, (i.e. Microsoft Producer) Mini-Digitized video tap(s) (x2)	$0.00 $10.00 (each)$20.00 **$200.00**
Total:	(Subtotal)	**$5,700.00**

Table 2. Funding Table.

The purchase of new equipment would have totaled $5,700.00. But since most of the equipment was borrowed from the Naval Post Graduate School, the cost was merely $10.00 each for the digitized videotapes. There would be little costs involved for the USS CARR. Since they already have the necessary equipment to download and view and the lessons, the cost would be the time spent away from daily activities.

b. Return on Investment

The USS CARR should expect to see several ROI benefits. First, the USS CARR should be able to find more in-depth content and access to a staggering amount of information after downloading the digitized video. It can be stored and reused again and again at the user's leisure. Second, the USS CARR should be able to see increased ways to relate the content to a trainee's personal experience. The user aboard ship is not only familiar with the environment, but will be performing what was learned there as well. Third, there will be a wider variety of sensory stimulation, particularly visual and audio. The volume and picture can be adjusted to fit the needs of the user. Fourth, there will be

greater flexibility in accommodating an individual's learning style. If the users do not grasp the concept right away, then they can stop the video wherever they choose, rewind, and replay. Fifth, there will be an unequivocal opportunity to simulate real-life situations in a safe environment. Safety measures taken are more realistic on board ship than in a classroom. Sixth, training can be disseminated to remote sites using consistent standards. No matter where the users are, as long as they have access to the Internet and a computer, they can obtain the needed training. Last, and most important, the web-enabled digitized lessons will reduce travel costs, employee time in training, and time away from work.

The USS CARR's CO was pleased with the final product he received from this experiment. Realizing this experiment was just an introductory prototype, he has expressed expanding this methodology to other training areas for his personnel. This project has demonstrated the enormous potential of streamlining video and using it to educate and to train sailors while deployed on a ship. The cost and time savings of such a concept could save the Navy millions of dollars a year in a time of reduced budgets. The primary challenge for this process is how much bandwidth is available on the ship, since bandwidth is not an unlimited resource at sea. Future technologies will likely resolve this problem, which in turn will also increase the speed of delivery as well as the quality of the sound and the picture. More important, this experiment showed that unless one is very familiar with the process of creating a web-enabled digitize video and forwarding it to a designated unit, it is quite complex.

C. EXPERIMENT TWO: VHS VIDEO COURSE CONVERTED TO DIGITAL

This experiment entailed working in a classroom with distance learning equipment. All the steps in experiment one were followed except for using the initial camcorder to capture the video. It allowed the instructor to communicate with the class as well as employ power point slides. The major drawback was that the equipment used required a VHS tape, which had to be converted to a digital form later.

The process of converting the VHS to digital form and then editing the final product took longer than experiment one. In addition, since the dada were transferred several times the quality was not very good.

D. EXPERIMENT THREE: COMBINING THE METHODS FROM EXPERIMENT ONE WITH TRADITIONAL LEARNING

Experiments one and three were exactly alike, except that experiment three achieved a more professional level of quality as a result of the advanced equipment used. Consequently, the digitized video was of excellent quality, and the software manipulation was virtually unneeded due to the quality of the camera. No tape was needed because the camera could record three hours of video before it had to be downloaded to a computer. Once downloaded, it was already compressed and provided the option of streaming over the Internet or simply watching it in digital form. Figure 5 illustrates a mini-high performance digital camera. The only concern, as mentioned earlier in this chapter, was the very high cost of the equipment.

Figure 5. A High Performance Mini-Digital Camera.

The major advantage of experiment three was its ease of operation, and that it clearly captured and manipulated every feature the professor wanted to present. The major disadvantage was the equipment itself and that the software needed to support the equipment was extremely expensive

E. SUMMARY

Web-enabled digitized video in a learning environment is a concept that has undoubtedly become a reality. Although numerous problems developed with each experiment, the experiments proved that the concept is feasible. In fact, the experiments showed that web-enabled video is possible today. As demonstrated in experiment one, the initial process of digitally recording a subject and then forwarding it over the Internet is very cumbersome and time consuming. The main problem is manipulating video and audio after they are captured in digitized form.

The second experiment took a different approach. It used distance-learning tools, which enable the instructor to be recorded on a VHS tape while conducting interactive video conferencing with several classrooms. Even though it was easier to capture the course and it was easier for both the instructor and the students to interact, once the VHS was converted to digital form, the video and sound quality decreased significantly. Consequently, experiment two proved to be an inadequate method for web-enabled digitized learning.

Experiment three, if cost were not and issue, yielded the best method to use for web-enabled digitized learning because it used very sophisticated studio recording equipment along with interactive classroom technology. Once the data was captured, the video did not have to be manipulated because the video was actually captured in a digitized form ready to be sent over the Internet or simply displayed as a film.

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IV. PLANNING, ORGANIZING, AND IMPLEMENTING PROCESSES

> This involves a couple of things. First, we must ensure that our *organizations*, systems, and processes are aligned to deliver exactly what they are designed to produce — a combat-capable Navy, ready to sail into harm's way. Second, alignment involves clear *communication*, from the recruiter, to the LPO, to the CO, to the CNO. It's about communicating realistic expectations and then helping Sailors accomplish realistic goals — in a word, credibility.
>
> CNO – Alignment

A. INTRODUCTION

An organization or a project for web-enable digitized learning should function as intended and achieve its objectives. That means that it must be working efficiently and personnel must meet the organization's objectives and expectations. To maintain alignment within this sort of project, the organization and project manager must constantly evaluate its output. The project manager cannot tell if the project has achieved its objective until the output from the digitized video has been analyzed. This process is one of continuous improvement, but many management techniques exist that can assist in helping the project run as smoothly as possible.

B. VARIOUS TECHNIQUES TO ASSIST IN MANAGING DISSEMINATION OF A DIGITIZED COURSE

1. Networks Management

Network Management (NM) is the sum of all activities and products to plan, configure, control, monitor, recover faults, tune, and administer computer networks and distributed systems. If properly done, the NM system, as shown in Figure 6, can help a web-enabled digitized video process from creator to user. The following illustrates the elements of network management as a whole.

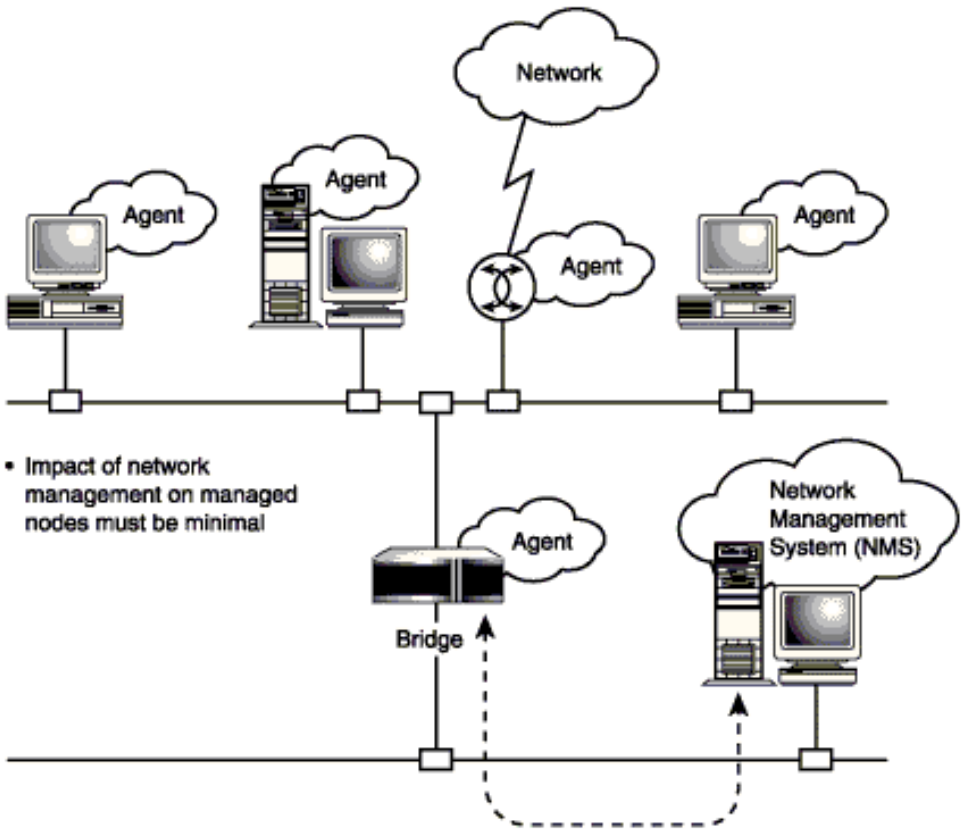

Figure 6. Network Management System. (From: Network Management Brief, NPS IS Capstone Course)

2. Customer Relationship Management

Customer relationship management (CRM) is a very important aspect of the overall management for a web-enabled digitized video learning project. CRM is concerned with meeting the needs of the customer while simultaneously helping them help themselves.

First, the customer and their needs for web-enabled digitized video must be thoroughly understood. Once that is established, there are eight specific areas that should be concentrated on to achieve the highest customer satisfaction. In this thesis, the sailors aboard USS CARR are our customers, and to meet their needs, it is important not only to understand the resources such as software, hardware, and historical data, but also how to relate to the customer. The following eight areas (a to g) of CRM, whenever possible, should be applied to creating and disseminating web-enabled digitized video in a learning environment.

a. Target the Right Customer

It is vital that managers of a web-enable digitize video project go out of their out their way to acquire customers who need this method of learning. Customers are like the sailors, aboard the USS CARR, who want and need the lesson but lack the time to partake in a traditional classroom. By actively advertising whether on the web or in the *Navy Times*, the feedback will determine who these customers are. By offering specific training and accepting requests for unit-specific training, project managers can determine true need for any particular subject and provide the web-enable digitized video accordingly. With time and research, customers, professors, and stakeholders will be identified and their needs will be met

b. Own the Customer's Total Experience

Now that web-enabled digitized video has been in existence for a while, many people have testified as to how pleasant the process was. Students who receive web-enabled video training can achieve their educational goals. In addition, since the lessons are web-enabled and available at any time the customer can achieve their goals in less time and with less frustration by using this method in conjunction with traditional learning.

c. Streamline the Processes That Impacts the Customer

Once the student has become familiar with the process of acquiring the web-enabled digitized video, the student becomes self-sufficient and often encourages others. If the lessons are sorely needed, and the lesson is digitally stored at their organizations facility, the learning processes are reiterated and streamlined to the point that if the steps are followed, the system is virtually foolproof.

d. Provide a Complete Understanding of the System

If the students have concerns on any area of the lesson, whether it involves how to download the file or a specific subject matter, they can access a list of answers to frequently asked questions, or contact the customer service department. The customer service department would consist of professors who teach the lesson and technical advisors who create the web-enabled digitized video.

e. Let Customers Help Themselves

Through CRM, professors and web-enabled digitized video project managers could encourage all students to keep in touch with one another and to maintain a good rapport. This allows them to exchange questions and ideas and to receive referral from one another, thus creating an interactive environment. This is done via email, chat, postal service, telephone, and periodic and conferences

f. Help Customer Do Their Jobs

This is a continuous effort for web-enabled digitized video in a learning environment. The steaming video, downloads, DVD or VHS is geared toward educating and enabling individuals to improve in whatever area they are lacking. A person who is highly educated normally exhibits a higher level of professionalism.

g. Deliver Personalized Services

Implementing CRM into the web-enabled digitized video creation, dissemination, and maintenance techniques ensures that the customer receives personal attention. This is done by the professor, the video creator, and the student peers as well. All personnel involved do their part to ensure that the student's needs are being met and assist them in the process of learning all they can through web-enabled digitized video.

h. Foster Community

Web-enabled digitized learning fosters community among customers, but the area that does it the most is the recognition of similar interests. If students see other students receiving training through digital video, they are often inspired to do the same, and in turn develop camaraderie. This solidarity helps reinforce their desire to keep learning. CRM allows the student, the professor, and the web-enabled digitized video creator to determine if this is the right vehicle to achieve their goals.

3. Knowledge Management

Knowledge has become the preeminent economic resource, in some cases, even more important than money. Considered as an economic output, information and knowledge are more important than automobiles, oil, steel, or any of the products of the Industrial Age. Figure 7 illustrates the processes of combining traditional learning with digitized learning over the Internet, providing faster and higher quality information (HQI)

or information that is more detailed to the learning needs of the student, thus improving the learning product. (T. A. Stewart, "Intellectual Capital: *The New Wealth of Organizations*, 1997, p. 6)

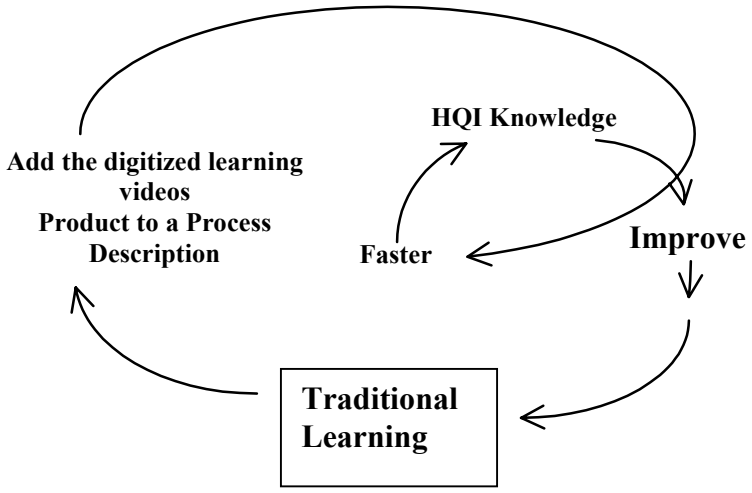

Figure 7. Learning – Knowledge – Value Spiral.

Understanding the importance of knowledge places an even greater significance on web-enabled digitized video in a learning environment. In today's Internet world, the knowledge acquired by personnel is easily accessible, and much of the knowledge on the Internet may be less desirable than the knowledge obtained from web-enabled lessons. Combining web-enabled digitized video lessons with traditional learning provides the best of both worlds.

C. SUMMARY

To create smooth running processes, a web-enabled digitized video project should be well organized. Tools such as networks and knowledge management can help achieve this objective.

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V. CONCLUSION AND RECOMMENDATION

A. SUMMARY OF RESEARCH AND EXPERIMENTS

Quality of Service (QOS) is the ultimate goal when one creates and disseminates web-enable digitized video. Taking into consideration how certain technologies will become obsolete and how others will dominate, it is important to keep up with the latest hardware, software, and techniques in order to provide the best possible web-enabled digitized video for a learning environment.

In conclusion, as indicated from the three experiments, web-enabled digitized video in a learning environment is feasible and extremely beneficial for the students as well as the professors. Through advanced technology and multimedia hardware and software, combined with traditional learning methodologies, the customer needs are undoubtedly met. The downside to the entire process is that creation, implementation, and maintenance of digitized video can be very time consuming and is not as simple as previously assumed.

B. RECOMMENDATIONS AND FUTURE WORK

Recommend that video creators gain a full understanding of the recording equipment, computer software and hardware needed for digitizing and web-enabling a video lesson. Students and professors should be surveyed on their needs prior to starting the project. Specifically, the video creator and the professor should research and plan their processes, and then implement and provide a test pilot prior to disseminating the final video. In addition, it is recommended that professional recording equipment be used whenever possible.

In the future, there will likely be better, faster, and a more user-friendly technology than that which exists today. Therefore, web-enabled digitized video combined with traditional learning methodologies must continuously advance, which in turn should enhance the overall process of learning.

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APPENDIX. USS CARR CONTRACT

A. INTRODUCTION

1. Assignment Contract

Web-Enabled Digitized Video Lesson 1 of 20

Instructor:	Doe, John, - Professor
Sponsor:	CDR Swain, Tony - Commanding Officer, USS CARR
Sponsor POC:	CDR Swain, Tony/Email: co@carr.navy.mil
Consultants:	Westmoreland, Lanier (Project manager)
Purpose:	The purpose of this project is to determine the level of complexity in forwarding web-enabled digitized video for a learning environment. At the conclusion of the research, digital taping, editing, and testing processes, it will be clear as to how difficult or easy it is to forward a subject normally taught in a class room environment to the designated unit.
Roles:	Project manager will provide overall supervision for the project.
Responsibilities:	Fulfill requirements. Sponsor will provide subject matter data requested by the consultant. Consultant will adhere to all terms of the contract agreement.

2. Assignment Contract

Web Based Digitized Video Project

Thesis Experiments one, two, and three

a. Contract Agreement

By signing below/responding "accepted" to the emailed contract, the Project Manager, Lanier Westmoreland hereby accepts all obligations and responsibilities of this contract. By signing below, Consultants hereby agree to fulfill all of the conditions and terms of this contract, including but not limited to all contract terms listed below.

By signing below/responding "accepted" to the email, the Sponsor agrees to participate in the project.

b. Contract Terms

- An acceptable lesson will be digitally recorded, edited, and web-enabled.
- A cost benefit analysis will be conducted, to include potential return on investment (ROI).

- A working prototype of the lesson will be forwarded to the command via the Internet.

Signatures

Instructor: _____ Date:_____
Professor John Doe

Consultant Technical Advisor: _____ Date:_____
Lanier Westmoreland

Sponsor's acceptance response will be the signature.

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